X. "On a Method of graphically representing the Dimensions and Proportions of the Teeth of Mammals." By GEORGE BUSK, F.R.S. Received May 20, 1870.

Of all the hard parts of animals, the teeth, more especially for palæontological purposes, undoubtedly afford the most constant and the most generally available characters. Any plan, therefore, by which the study and ready comparison of these organs may be facilitated and simplified cannot fail to be of some use to the zoologist and palæontologist.

Having myself found the method I am about to describe convenient in many instances, more particularly in the case of fossil mammals, I have been led to believe, by the representations of several to whom it has been communicated, that it might be found useful by others, and consequently, though at first sight but a trifling matter, worthy of a place in the 'Proceedings' of the Society.

The characters afforded by the teeth are derived from their number, proportions (absolute and relative), and pattern.

In many cases the pattern of the teeth must undoubtedly be taken into account; but in a very great number it will be found that the number and proportions, more particularly of the premolars and molars, are sufficient for the purpose of diagnosis, or, at any rate, that a knowledge of these particulars alone will reduce the necessity for further comparison within a small compass. A good illustration of this is afforded in the smaller Felidæ, in which, owing to their high specialization, the pattern of the teeth is in the main so very closely alike as to render it of very little assistance in diagnosis, though not altogether.

The statement of the particulars above mentioned, in words or figures when numerous comparisons are needed, is tedious and laborious to both writer and reader; and even in the most carefully arranged tables it is difficult without close attention to perceive at once differences which though minute are, from their constancy, important and in fact necessary for the diagnosis of nearly allied forms.

My plan may be termed one for the graphic or diagrammatic representation of the absolute and relative or proportional dimensions and number of the premolar and molar teeth, or of those constituting the molar series, and which have appeared to me in most cases sufficient for the purpose in view. But of course the incisors and canines might be included in the scheme if thought requisite.

The method in which these "odontograms" are prepared will be at once obvious on inspection of the accompanying examples. Each horizontal line in the figures, which represent the maxillary and mandibular molar series of a species, corresponds to a single tooth, whose extreme length or antero-posterior diameter is indicated by the extent of the lighter shade, and its extreme breadth or transverse diameter by the darker shade. Both dimensions are, of course, measured from the same base-line.

The respective measurements, which may be taken with a pair of sharp-pointed caliper-compasses, having been pricked out upon the equidistant horizontal lines, the points showing the length and breadth of each tooth are connected by straight lines, and a sort of figure is thus obtained which, in nearly all cases, will be characteristic of the *genus* or *family*, and in many instances sufficient to determine the species also. In some cases, as for instance in *Canis* and *Viverra*, the odontograms are at first sight so nearly alike that recourse must be had to the pattern of the teeth in addition, as before alluded to.

In order to render figures of this kind easily comparable *inter se*, it is necessary that they should be drawn upon some common scale for the distance between the horizonal lines. This is, of course, entirely arbitrary, all that is requisite being that it should not be too great nor too small.

The accompanying odontograms are drawn upon a scale of ·25 inch = 6·35 mm., which appears convenient for the purpose; and is suitable for all teeth of the dimensions that readily admit of this mode of definition, that is to say, which are neither too large, as those of the Elephant, nor too small, as in the smallest mammals.

Moreover, if the figures are drawn upon ruled paper, the actual measurement of the size of the teeth can be read off at sight; and with this object I have employed paper ruled to a scale of ·05 inch.

The examples selected to show the application of the method above described have necessarily been limited to a very few. They include figures of the dentition of the Lion and Tiger, taken from the largest specimens of each species I have as yet met with; but they afford a fair illustration of the way in which even a slight specific difference is brought out, and which, in the case of these animals, is almost confined to the lower teeth.

The three odontograms of the genus *Ursus* represent the mean dimensions and proportions taken from numerous instances of each species, and they show at a glance the differences between them. In these the small anterior premolars have been purposely omitted to save space.

The odontograms of *Hyæna* are of the same kind.

The dentition of the genus *Canis* is exemplified by instances taken from the Wolf to the Fennec Fox, or from the largest to the smallest species, in order to illustrate the uniformity of the generic type throughout; and amongst these forms, two will serve to show how the method may be used in palæontological research. Plate IX. fig. 13 represents the dentition of the fossil Fox described by Messrs. Durand and Baker from the Siwalik Hills, and fig. 14 that of the existing *Canis bengalensis*, which would thus appear to be the close representative of its supposed miocene progenitor, a resemblance which further comparison of the skulls only serves to render still more obvious. The other figures are introduced merely to indicate the variety of forms produced in this way from the measurements of the teeth of different *genera*.

DESCRIPTION OF THE PLATES.

PLATE VIII.

Fig. 1. *Felis leo* (max.).
2. —— *tigris* (max.).
3. —— *jubata* (mean).
4. *Ursus ferox* (mean).
5. —— *arctos* (mean).
6. —— *maritimus* (mean).
7. *Hyæna crocuta* (mean).
8. —— *brunnea* (mean).
9. —— *striata* (mean).

PLATE IX.

Fig. 10. *Canis lupus.*
11. —— *aureus.*
12. —— *vulpes.*
13. —— *bengalensis* (fossilis).
14. —— —— (hodie).
15. —— *zerda.*
16. *Sus scrofa* (ferus).
17. —— *domesticus.*
18. *Equus caballus.*

XI. "Note on the Spectra of Erbia and some other Earths." By WILLIAM HUGGINS, LL.D., F.R.S. Received May 26, 1870.

Bahr and Bunsen have shown* that erbia, rendered incandescent in a Bunsen's gas-flame, gives a spectrum of bright lines in addition to a brilliant continuous spectrum. As they were unable to discover the bright lines in the flame beyond the limits of the solid erbia, they suggest that the light which is dispersed by the prism into bright lines is emitted by the solid erbia, which substance therefore appears to stand alone, as a remarkable exception, among solid bodies. Bahr and Bunsen found the spectrum of bright lines to coincide very nearly with the absorption spectrum of some compounds of erbium.

A few weeks since, when in Ireland, I made the observation that the spectrum of the ordinary lime-light contains bright lines†. Dr. Emerson Reynolds, Director of the Laboratory of the Royal Dublin Society, kindly undertook to make experiments to ascertain from the position of the lines if they were due to the cylinder of lime, or to impurities contained in it.

Upon my return to town I made the following experiments; shortly after commencing them I received from Dr. Reynolds the account of his experiments, which, with his permission, I have added to this note.

Erbia.—A few months since I received, through the kindness of Dr. Roscoe, F.R.S., a few grains of nitrate of erbia, which he had procured from a trustworthy source. I followed Bunsen's method of placing it with syrupy phosphoric acid upon a platinum wire. The erbia, obtained by this method in a finely divided state, was then submitted to the heat of the oxyhydrogen blowpipe.

In all the experiments described in this paper hydrogen alone was first turned on, and the effect of the heat of the flame on the substance under examination observed with the spectroscope. Oxygen was then admitted slowly, and the effect of the increased heat carefully noted.

With the flame of hydrogen alone, the lines represented in the map

* Liebig's Annalen, Bd. lxi. (1866) S. 1.

† Dr. W. Allen Miller informs me that in 1845 he noticed a bright line in the spectrum of the diffused light of the oxyhydrogen jet reflected from a sheet of paper.